

USAWC STRATEGY RESEARCH PROJECT

**LEVERAGING THE STRATEGIC VALUE OF THE U.S. INLAND WATERWAY  
SYSTEM**

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This SRP is submitted in partial fulfillment of the requirements of the Master of Strategic Studies Degree. The U.S. Army War College is accredited by the Commission on Higher Education of the Middle States Association of Colleges and Schools, 3624 Market Street, Philadelphia, PA 19104, (215) 662-5606. The Commission on Higher Education is an institutional accrediting agency recognized by the U.S. Secretary of Education and the Council for Higher Education Accreditation.

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Report Documentation Page			Form Approved OMB No. 0704-0188		
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE <b>30 MAR 2007</b>		2. REPORT TYPE <b>Student Research Project</b>		3. DATES COVERED <b>00-00-2006 to 00-00-2007</b>	
4. TITLE AND SUBTITLE <b>Leveraging the Strategic Value of the U.S. Inland Waterway System</b>				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S) <b>Donald Jackson</b>				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) <b>U.S. Army War College, Carlisle Barracks, Carlisle, PA, 17013-5050</b>				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT <b>Approved for public release; distribution unlimited</b>					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT <b>See attached.</b>					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT <b>Same as Report (SAR)</b>	18. NUMBER OF PAGES <b>25</b>	19a. NAME OF RESPONSIBLE PERSON
a. REPORT <b>unclassified</b>	b. ABSTRACT <b>unclassified</b>	c. THIS PAGE <b>unclassified</b>			

## **ABSTRACT**

AUTHOR: Colonel Donald E. Jackson, Jr.  
TITLE: Leveraging the Strategic Value of the U.S. Inland Waterway System  
FORMAT: Strategy Research Project  
DATE: 14 March 2007      WORD COUNT: 6,548      PAGES: 25  
KEY TERMS: Transportation, Freight, Infrastructure  
CLASSIFICATION: Unclassified

The United States is currently the international leader in economic prosperity, producing the highest Gross Domestic Product (GDP) in the world. As the only remaining military superpower, the United States also has the ability to rapidly project combat forces anywhere in the world to protect its vital national interests. Experts, however, predict U.S. economic dominance may be overcome by the year 2020. Globalization creates unlimited potential for both international economic growth and conflict around the world. In order to maintain a competitive edge, the United States must assure the strategic mobility of our economic and military elements of power. This project examines the strategic value inland waterways provide to the current and future economic prosperity and national security of the United States. The research reveals that the strategic contributions of these inland waterways are not well understood. The lack of adequate understanding impacts decisions contributing to efficient management, adequate funding, and effective integration with other modes of transportation at the national level. Recommendations demonstrate that leveraging the strategic value of U.S. inland waterways will contribute to building an effective and reliable national transportation network for the 21<sup>st</sup> Century.



## LEVERAGING THE STRATEGIC VALUE OF THE U.S. INLAND WATERWAY SYSTEM

The object of your mission is to explore...the most direct and practicable water communication across this continent for the purposes of commerce.

—Thomas Jefferson<sup>1</sup>

The importance of a viable national transportation system to the security and economic prosperity of the United States is even more important today than it was at the time of the Lewis and Clark Expedition. Accessibility to world markets, providing quality goods at competitive pricing, and adaptability to an ever-changing environment characterizes the explosive growth of the U.S. economy over the past century. The 21<sup>st</sup> Century, however, provides interesting challenges for which we may be ill prepared. The era of globalization provides unique opportunities for other nations and international coalitions, such as the European Union (EU), to prosper and compete in international markets, challenging the preeminent standing of the U.S. economy.

Economists predict the U.S. economy will double, if not triple, between now and the year 2020.<sup>2</sup> Globalization reinforces the need for highly efficient connections where the U.S. and international transportation networks meet.<sup>3</sup> Feeding these connections, domestically, are a myriad of road, rail, and waterway networks ensuring American export commodities can reach their international destinations. No single domestic transportation industry, whether trucking, rail, or waterway, can provide universal coverage for all commodities. Integrating industry capabilities is essential to ensuring cargo is delivered to port in the most efficient and cost-effective manner. Each industry plays an important role in the movement of freight, whether hauling large quantities of bulk commodities or perishables over great distances, carrying smaller packages to the main streets and back roads of America, or flying high-value merchandise to and from our trading partners abroad.<sup>4</sup> The collaborative efforts of U.S. transportation industries, and the infrastructure upon which they operate, provide the lifelines of American economic prosperity. Viable transportation infrastructure is essential to our national security, providing power projection platforms access to sea and aerial ports of embarkation capable of rapidly moving American military forces, equipment, and material anywhere in the world. Capable and reliable transportation infrastructure is a vital national interest of the United States. Domestic transportation infrastructure must be efficiently managed, adequately funded, and effectively integrated at the national level to serve as productive commercial conduits that support future economic growth. The United States has become one of the wealthiest nations

in the world, in part, by leveraging its reliable and effective transportation infrastructure; only through further advancements in this imperative system will it maintain this status.<sup>5</sup>

Transportation infrastructure requires a strategic-level approach to management, funding, and integration. National policy makers must balance the strengths and limitations of each transportation industry sector, ensuring their collective capabilities support projected U.S. economic and national security requirements. Based upon the capabilities inherent in each of these industries, supporting infrastructure must be available, expanded, or modernized that enable them to meet current and future transportation requirements. American transportation infrastructure requires continual investment to remain a viable means of moving freight, as well as routine maintenance, periodic modernization, and expansion to maintain adequate operability. The federal government has a Constitutional responsibility to provide adequate transportation infrastructure that supports the nation's economy, as a means of regulating interstate commerce. While federal responsibilities for transportation infrastructure are collectively substantial, they are, however, widely disbursed and not well coordinated.<sup>6</sup> Congress is responsible for synchronizing the efforts of industry stakeholders and government entities, making tough decisions on resource allocations that collectively meet the strategic requirements of the transportation system. This effort requires both an interagency and intra-governmental approach.

This study begins by providing an overview of U.S. domestic transportation infrastructure (road, rail, and waterway), highlighting the important contributions of each supporting industry. In addition to the value added there are challenges to maintaining operability for current and future demands on this transportation infrastructure from a national perspective. These challenges may impact our ability to meet the future capacity requirements of a growing economy. Second, the study examines several objectives of the U.S. Department of Transportation (USDOT) national strategy for overcoming these challenges, focusing on the draft 2006 *Framework for a National Freight Policy* as a potential way ahead. Finally, this paper highlights the U.S. Inland Waterway System, addressing the potential contributions of inland waterways, making recommendations that might alleviate the capacity challenges placing attainment of the nation's strategic transportation requirements at risk.

## U.S. Domestic Transportation Infrastructure

U.S. domestic transportation infrastructure consists of a complex network of roads, railways, and inland waterways. Freight transportation enables economic activity, and trucking is a key element of freight transportation. Whether measured by value, weight, or ton-miles,

trucking is the most frequently used mode of transport in America. Trucks currently haul approximately 34.4% of total cargo as measured in ton-miles.<sup>7</sup> The vast interstate highway system remains the primary artery for overland transport, although secondary roads and state highways link most freight with origins, destinations, or cargo transfer sites. The condition and performance of the highway system are crucial to the efficiency and effectiveness of trucking. Recent growth in truck traffic is placing greater burdens on the highway system. Although commercial vehicles currently account for less than 10 percent of all vehicle-miles of travel, truck traffic is growing faster than passenger vehicle traffic and is having major effects on intercity highways. Trucks already account for more than 30 percent of traffic on about 20 percent of Interstate System mileage. This share is projected to significantly increase based on a projection that the demand for freight transportation will double over the next 20 years. This growth in trucking is stimulated by economic growth as well as factors such as increased demand for just-in-time deliveries, major reductions in railroad track mileage and decentralization of business establishments. Trucking may be seen by the traveling public as an unwanted competitor for space on congested highways, but that same public depends on trucking to meet the logistics needs of businesses and households. Highway condition and performance, including congestion, have a significant effect on the costs and efficiency of trucking.<sup>8</sup> By 2020, projected increases in truck volumes of 62 percent and rail freight volumes of 44 percent will strain the U.S. freight transportation system. Shippers favor trucks for speed and reliability, but increasing truck traffic aggravates highway congestion creating significant social, economic, and environmental problems.

Railroads provide shippers with cost-effective freight transportation, especially for long-distance trips and heavy and bulky commodities.<sup>9</sup> In 2004, Class I railroads in the United States transported 1.8 billion tons, the highest originating tonnage ever. This record tonnage reflects steady growth in rail traffic for six straight years. U.S. freight trains serve almost every economic sector in the nation, hauling approximately 31.1% of total cargo as measured in ton-miles. Railroads are unique among transportation industry sectors. Railroad infrastructure is privately owned and operated with access limited to the owners of the track.<sup>10</sup> Although the railroad industry is now competitive and productive, railroads are very capital-intensive industries. Railroads are not attracting enough long-term investment, and the freight-rail system may not expand proportionate to economic growth if current trends continue. Unlike most other transportation industries, railroads receive very little subsidy from federal or state governments and rely on their ability to raise necessary capital for maintenance and improvements. U.S. railroads are hauling more freight than ever before and rely more heavily on a shrinking and

aging infrastructure. These traffic increases result in capacity constraints and service issues at certain junctions and corridors within the rail network. In fact, excess capacity has disappeared from many critical segments of the national rail system altogether.<sup>11</sup> Failure of the railroad industry to expand exponentially with national economic growth pushes additional freight traffic onto other modes of transport, leading to increased congestion along surface transportation corridors.

As our road and rail networks have become increasingly congested and near maximum capacity, we must look to the inland waterway system as a solution.<sup>12</sup> The inland waterway system provides an alternative to overland transportation, reducing congestion plaguing existing road and rail infrastructure. Inland waterways account for approximately 11% of total domestic freight (as measured in ton-miles), third behind road and rail.<sup>13</sup> Principal commodity groups include coal, petroleum, farm products, chemicals and crude materials such as aggregates for construction and other minerals. Total volume ranges around 630 million tons annually, and about 300 million ton-miles. Coal is used to generate over half the electricity produced in the U.S. and the inland waterways transport about 20% of this energy source.<sup>14</sup> The Mississippi River System is the most important commercial navigation corridor, consisting of the Mississippi River and its multiple connecting tributaries. The majority of U.S. navigable rivers and canals are in the eastern half of the country. The Columbia, Sacramento, and San Joaquin Rivers are the only major navigable rivers on the West Coast. The Department of the Army, with the U.S. Army Corps of Engineers (USACE) as its executive agent, has statutory responsibility for operating and maintaining all U.S. navigable waterways, excluding the Saint Lawrence Seaway. The Corps maintains more than 12,000 miles of inland waterways, owning or operating 196 commercially active lock sites with 241 lock chambers for the federal government. These waterways integrate a system of rivers, lakes, and coastal bays improved for commercial and recreational transport. Locks provide the essential infrastructure that allow tows to “stairstep” their way through the system and reach distant inland ports such as Minneapolis, Chicago, and Pittsburgh.<sup>15</sup> Most of the locks supporting the inland waterway system are antiquated and in need of repair, expansion, and modernization. Many of the Corps-owned or operated locks are well past their planned design life of 50 years. Of the locks still in use in the United States, 30 were built in the 19<sup>th</sup> Century and another 92 locks are more than 60 years old.<sup>16</sup> Nearly 50% of all Corps-maintained locks were considered to be functionally obsolete by the beginning of 2005. Assuming no new locks are built in the next 20 years, by 2020, another 93 existing locks will be obsolete. This means that 80 percent of locks now in service are beyond their planned design life, casting doubt of the reliability of the system as a whole. The physical condition of the

inland waterway infrastructure recently received a grade of D- from the American Society of Civil Engineers (ASCE) in their 2005 Report Card for America's Infrastructure, released in March 2005.<sup>17</sup> The report highlights the concern that lock condition is declining at the same time waterway usage is increasing. This is a significant challenge facing the inland waterway system, indicative of problems facing other industry sectors as well, casting doubt on the future viability of our national freight transportation system.

Historically, the transportation infrastructure of the United States has allowed this country to become the world economic powerhouse it is today by providing a high quality, inexpensive, and expansive network of roads, bridges, rails, inland waterways, and ports.<sup>18</sup> This expansive system requires full integration of all transportation modes through an efficient national intermodal network. Intermodal freight transportation defines the transit of cargo through two or more modes from origin to its final destination. As the U.S freight transportation system advances further into the 21<sup>st</sup> Century, the need for managing the demand on the system and monitoring the volume of freight handled by each transportation mode becomes more critical.<sup>19</sup> Each mode contributes to meet strategic freight transportation requirements, improving the efficiency of the U.S. national economy holistically. Individual industries offer unique capabilities historically preferable to various commodity shippers; however, advances in technology and operating procedures now open opportunities for more flexible origin to destination transportation planning. Adopting a more balanced approach among transport modes should be a national objective, potentially leading to increased throughput and lower costs to shippers and potential customers.

Transportation infrastructure supports our national security as well as our economy. The Defense Transportation System (DTS) is an integral part of the U.S. national transportation system. Close coordination among a wide variety of military and federal agencies is essential to meeting national wartime or contingency transportation requirements. The U.S. Transportation Command (USTRANSCOM) provides the process for Defense Department (DOD) global transportation management. This process establishes an integrated transportation system that is used across the range of military operations, providing the most effective use of all transportation modes from origin to destination.<sup>20</sup> In 2003 the Secretary of Defense designated USTRANSCOM the Distribution Process Owner (DPO). As the DPO, USTRANSCOM develops and directs the Joint Deployment and Distribution Enterprise to globally project national security capabilities.<sup>21</sup> Future distribution requirements are not limited to contingency operations in distant lands. The Defense Transportation Coordination Initiative is a distribution initiative that contributes to logistics transformation. This concept identifies use of a transportation

coordinator to integrate and synchronize movement of freight within the continental United States.<sup>22</sup> This coordinator leverages the entire transportation industry, streamlining the process of moving a variety of DOD cargo. In 2005, USTRANSCOM's Surface Deployment and Distribution Command (SDDC) synchronized 212 vessel operations and the related land movement by truck, rail, and barge in support of DOD operations worldwide, moving over 22,239,700 square feet of unit cargo.<sup>23</sup> Since USTRANSCOM works with a variety of commercial assets, services, and systems, it must continually grow the partnership with industry to incorporate current technology, anticipate trends, and develop future capabilities.<sup>24</sup>

### Challenges Facing the U.S. Transportation Infrastructure

The ability of existing domestic transportation infrastructure to support future economic growth may be at risk. The tremendous growth in the U.S. economy continues to add great pressure on our domestic transportation infrastructure, much of which currently operates at or near maximum capacity. By 2020, the nation's freight tonnage is projected to increase nearly 70%.<sup>25</sup> Many critical gateways of our freight transportation infrastructure, particularly intermodal transfer facilities and stretches of road and rail corridors, are located in or near major urban areas. Increases in local traffic combined with greater volumes of freight throughput over time create bottlenecks in the system resulting in congestion, delay, and higher shipping and travel costs.<sup>26</sup> The challenges involved with integrating the nation's freight transportation systems, and the jurisdictional issues that arise, are perhaps most apparent at these interconnections of the nation's inland ports, public highway systems, and private railroads.<sup>27</sup> At these points, federal, state, local, and private sector interests and responsibilities intersect, but they are difficult to coordinate because of differing planning horizons, resource constraints, and investment priorities.<sup>28</sup>

The capability of existing transportation infrastructure to meet a growing future demand should be cause for concern by Congress and other national policy makers. U.S. freight transportation infrastructure is not efficiently managed, adequately funded, or effectively integrated at the national level. Our ability to efficiently move cargo from domestic origins to international destinations at the lowest cost possible ensures our economic stability and national security. A capable and reliable freight transportation infrastructure is the necessary means to accomplish this national end state.

U.S. freight transportation infrastructure is inefficiently managed at the national level. National policy makers must provide effective oversight to ensure transportation industries can provide the required capability and capacity necessary for our economy to grow and prosper.

They do this through establishing policies and regulations that balance the contributions of each industry to manageable levels in order to avoid congestion and competing interests.

Inefficiencies emerge when leaders fail to capitalize on available technologies and business practices to streamline operations that naturally lead to more adequate traffic management, improved reliability, and lower shipping costs. National transportation advisors should provide incentives to encourage industry cooperation and interdependencies that more efficiently move cargo from domestic origins to the nation's ports for shipment overseas. Congestion is a problem facing all forms of domestic transport. The USDOT *2006-2011 Strategic Plan* recognizes this shortfall and addresses the reduction of congestion as a national strategic goal. Congestion reduces both capability and reliability. Although road and rail traffic have long dominated the transport market, the ability to expand this infrastructure to meet the increased demands of a growing economy are limited. These limitations are caused not only by congestion, but also right of way development, fuel prices, and concerns over vehicle emissions.

Second, U.S. domestic transportation infrastructure is inadequately funded to remain a reliable and capable artery for international commerce. While much of the transportation infrastructure in the United States is becoming antiquated, our international competitors are improving their infrastructure and, consequently, their competitiveness in world markets.<sup>29</sup> Most freight transportation infrastructure, with the exception of railways, is publicly owned. In the case of highways and waterways, an intra-governmental approach is used for operations and maintenance as well as new construction. To make matters worse, state and local authorities own the intermodal facilities through which the national transportation arteries traverse, leading to unsynchronized modernization and expansion efforts. In each case the cost is extremely high, resulting in delayed response to needed repair and a cascading failure of the infrastructure to support needed transportation requirements. "Fix it when it breaks" is not an effective method of maintaining reliability. For the most part, users of freight transportation infrastructure pay little in comparison to the benefits they reap for its use. National policy makers and industry stakeholders continue to examine new and innovative ways of funding operations and maintenance but it is often too little, too late.

Finally, U.S. transportation infrastructure is ineffectively integrated at the strategic level. Today businesses depend on the interconnected transportation network to move a myriad of goods, from raw materials such as lumber, coal, and petroleum products to manufactured goods including medical supplies, furniture, household appliances, and computers.<sup>30</sup> The current freight transportation architecture operates, without effective collaboration, as stove-piped

organizations with minimal communication and planning between industries. Stakeholders operate independently, as opposed to interdependently. Integration is not a priority because it is not yet an absolute necessity. The rail and trucking industries are currently meeting their freight capacity requirements and see integration as a potential loss of business. For example, the inland waterway system is not fully integrated or synchronized with other transportation industries due to the lack of capability and accessibility of road and rail options in place; this despite increasing demands for commercial transportation capacity on the inland waterways. As our nation has matured both physically and legislatively, the inland waterway system has fallen under the jurisdiction of many levels of governmental structure. Local, regional, state, and federal guidelines and regulations on use and expansion of the waterways affect several portions of the potential inland river transportation system. These overlapping regulatory boundaries present seams that impose unique challenges toward further improvements in the system.<sup>31</sup>

#### National Strategy for Improvement

The USDOT is the lead government agency responsible for integrating the national freight transportation system. The USDOT provides a national strategic vision for transportation in the draft 2006 *Framework for a National Freight Policy*. To support economic growth and provide for national security our domestic transportation infrastructure must be efficiently managed, adequately funded, and effectively integrated at the highest level. Throughout the 1900's, the growth of the United States was directly related to capital investment by the federal government in freight infrastructure supporting the movement of finished goods, raw materials, farm products, and people.<sup>32</sup> According to new estimates, over 19 billion tons of freight, valued at \$13 trillion, was carried over 4.4 trillion ton-miles in the United States in 2002. This means that on a typical day in the United States in 2002, about 53 million tons of goods valued at about \$36 billion moved nearly 12 billion ton-miles on the nation's transportation network.<sup>33</sup> In addition, global deployments from bases in the continental United States increases the demand for surge transportation resources, compared to relying on overseas garrisons.<sup>34</sup> A key element of the U.S defense strategy is the capability for power projection-the ability to quickly move troops and supporting equipment worldwide and to sustain their presence if necessary.<sup>35</sup>

The number one objective of the *Framework for a National Freight Policy* is improving the operations of the existing freight transportation system, developing efficiencies that maximize the contributions of existing infrastructure. The policy proposes several strategies leading to the creation of a more efficient and effective system at the national level. The first of these

strategies directs improvement of the management and operations at existing facilities.<sup>36</sup> Supporting this strategy are a number of tactics seeking to leverage better management practices, emerging technologies, and alternative transport options to mitigate strategic chokepoints in the freight transportation system. Creation of new infrastructure does not marginalize inefficient business practices. In fact, modern technologies could provide the ability to optimize existing infrastructure by carefully managing increasing traffic flows and creating seamless transfers between transport modes. The U.S. trucking industry leads other modes of transport in leveraging technology for efficient fleet management. Using global positioning satellite systems connected to integrated freight databases, managers effectively link cargo with trucks to maximize load efficiencies and minimize haul requirements.<sup>37</sup> Using similar technologies, this just-in-time technology could be possible to increase efficiency in other modes of transport.

A second strategy, supporting the improvement of existing freight transportation system operations, is maintaining and preserving existing infrastructure.<sup>38</sup> Supporting this strategy are funding objectives that prioritize federal investment in transportation infrastructure, targeting resources to existing intermodal connectors where the potential for the greatest efficiencies reside. Congress must address infrastructure maintenance requirements strategically and holistically. Measures must be consistent to ensure adequate funding is authorized and appropriated throughout the life cycle of each federally approved maintenance or construction project. The inland waterway system, for example, continues to suffer from inconsistencies in federal funding that cause numerous projects to be delayed or lie dormant for years. Funding inconsistencies hamper the ability of publicly owned freight transportation infrastructure to provide reliability for military planners and commercial shippers, regardless of commodity. Delayed and inconsistent funding increases the cost to the taxpayer for needed and timely repairs, raising the risk associated with multiple, simultaneous repair requirements in the future. This ultimately brings an even greater financial burden to the government and transportation stakeholders.

The *Framework for a National Freight Policy* recommends the need for both investment and public-private collaboration.<sup>39</sup> Historically the public and private sectors play clearly divided roles in relation to freight transportation: the public sector has built, owned, and operated transportation infrastructure, predominantly highways, and the private sector has used that infrastructure to conduct freight operations.<sup>40</sup> This division has limited the opportunities for leveraging private sector efficiencies and expertise in the construction and operation of freight infrastructure.<sup>41</sup> Infrastructure must be functional to effectively provide a means of efficient and

cost effective freight movement. Maintaining transportation infrastructure is an expensive, but critical, investment for the future. Construction of new infrastructure is time consuming, politically charged, and often not the answer to meeting economic mobility and power projection needs.

The number two objective of the *Framework for a National Freight Policy* is adding physical capacity to the freight transportation system in places where investment makes economic sense.<sup>42</sup> Focusing limited resources on high payoff targets is the only way to ensure the future effectiveness of our freight transportation system. There is insufficient time or funding to complete the endless list of desired upgrades or repairs across the full spectrum of the transportation industry. Integrated prioritization ensures key infrastructure with strategic implications are adequately funded and completed. Key *Framework* strategies supporting this second objective include: (1) facilitating regionally-based solutions for freight gateways and projects of national or regional significance, and (2) utilizing and promoting new financing tools that encourage private sector investment.<sup>43</sup> Effective integration of freight transportation infrastructure is especially tenuous due to the complications of intra-governmental interoperability. Political liabilities and constraints may involve considerations of union contracts, federal funds provided for work projects, state funded work projects, and the allocation of resources and work based on lobbying efforts to elected officials.<sup>44</sup> Strategically, each of these stakeholders must work together, keeping in mind the overall benefit of the system nationally, in lieu of local political and economic implications. Careful management of scarce federal resources requires strategic vision that cannot be clouded by partisan parochialism. Adequate maintenance of our current system is the answer, but this requires a reliable source of revenue to be effective.

Finally, effectively integrating the capabilities of road, rail, and waterway maximizes the throughput capability of existing infrastructure and provides needed redundancy for shippers. USDOT coordination of the U.S. Interagency effort includes liaison with the Executive Branch Departments of Commerce, Homeland Security, Agriculture, and Defense, as well as local and state governments and industry stakeholders. Strategic analysis provides the critical path in determining the best method of connecting the origins of freight with domestic and international destinations. Working with its national partners USTRANSCOM is mapping the Department of Defense (DOD) deployment and distribution process, from end to end, beginning with the point of origin of a commodity, the “factory”, to the forward-most point of distribution or point of effect where material travels its last mile to the “foxhole”.<sup>45</sup> This initiative assists identification of organizational, process, and information technology gaps that enable process improvements

through joint solutions.<sup>46</sup> This USTRANSCOM model provides some potential strategies that could be adopted at the national level to achieve effective integration in the commercial sector.

Intermodal facilities and operations are key to achieving effective integration. Intermodal facilities, such as inland ports, serve as cargo transfer points connecting competing industries in the freight transportation market. Intermodal facilities are the decisive points along the critical path of freight movement, effectively leveraging capacity and capability of multiple transportation industries. Unfortunately, many of these facilities have insufficient cargo handling infrastructure, minimizing effectiveness of a multi-mode approach to cargo transfer. These cargo transfer points are often excluded from state and local urban planning efforts, limiting access and constraining integration efforts. These constraints increase the costs of cargo transfer and thus marginalize efficiencies gained through integrating transport modes. The *Framework* recognizes this as a challenge, targeting existing facility improvement at these critical junctions as an objective to eliminate bottlenecks, focusing resources to developmental infrastructure at existing intermodal connectors.<sup>47</sup>

#### Contributions of the U.S. Inland Waterway System

Inland waterways present a possible alternative to overland transport that has been underutilized in the past. The EU recognizes and relies upon their existing water highways, committing to a more balanced approach for future transport. The core network links the Netherlands, Belgium, Luxemburg, France, Germany, and Austria via a myriad of easily accessible rivers and canals, carrying cargo such as heavy materials, bulk industrial goods, building products, containers, oversized loads, and waste. Inland waterway transport in the EU has experienced a growth rate of 17% over the past decade.<sup>48</sup>

Inland waterways are a strategic asset to the nation, enabling the U.S. to significantly increase economic output in both domestic and international markets, and project military power more rapidly and effectively into the 21<sup>st</sup> Century. Over the next 20 years economists estimate that inland navigation will increase by more than 35%.<sup>49</sup> The inland waterway system is a potential resource upon which we can increase the flow of military cargo. Continued application of technology to barge operations and integration of the inland waterway system into the nation's intermodal system makes this an area ripe for additional development.<sup>50</sup> Waterways already move important national defense resources and other supplies in large quantities for the armed forces.<sup>51</sup> As a mode of transportation, the inland waterway system is quiet, low profile, and off the public radar.<sup>52</sup>

U.S. Inland Waterways contribute to efficient management on a national level by offering an excellent alternative form of transport for a variety of non-traditional commodities. The inland waterway system is an efficient, cost-effective, and environmentally friendly way to move large volumes of bulk commodities, not requiring a fast transit time, over long distances. Towboats and barges do not compete with trucks and commuters in urban areas. Barging operations continue to improve, allowing more cargo to be moved with less effort. USACE promotes inland waterways as the most efficient mode of freight transportation. Towboats push barges lashed together to form a “tow”. A tow may consist of four or six barges on smaller waterways up to over 40 barges on the Mississippi River below its confluence with the Ohio River. A 15-barge tow is the most common barge configuration. Such tows are an extremely efficient mode of transportation, moving about 22,500 tons of cargo as a single unit. The cargo capacity of a typical barge is equivalent to that of 15 large railroad cars, or 58 semi-trucks. A representative 15-barge tow on a main stem waterway moves the same cargo as 870 trucks stretching 35 miles on the interstate highway system. That same 15-barge tow would require two 100-car unit trains, extending nearly three miles in length.<sup>53</sup> The inland waterway system is a cost-effective mode of transportation, saving shippers and consumers more than \$7.8 billion annually compared to alternate transportation modes.<sup>54</sup> Barges transport materials at relatively low cost per ton. The inland and intracoastal waterway system handles about 300 billion ton-miles of cargo annually, or about 18% of all intercity freight ton-miles.<sup>55</sup> This cargo principally includes raw materials and liquid and bulk primary products, like coal, petroleum, chemicals, grain, processed metals, cement, sand, and gravel.<sup>56</sup> It is the primary artery for more than half of the nation’s grain and oilseed exports, over 20% of the coal consumed to produce the electricity we depend upon to run our homes, offices, and industries, and about 22% of domestic petroleum movements.<sup>57</sup> On average, a gallon of fuel allows one ton of cargo to be shipped 70 miles by truck, 420 miles by rail, and 530 miles by barge.<sup>58</sup>

The inland waterway system is an environmentally friendly mode of transportation. Inland waterways allow America to realize tremendous savings in fuel consumption, reduced air pollution emissions from fuel combustion, reduced traffic congestion, fewer accidents on our rail lines and highways, and less noise and disruption in our cities and towns.<sup>59</sup> The EU promotes their waterways as an environmentally friendly alternative to road and rail.<sup>60</sup> Waterways offer an alternative to present patterns of transport growth and its reliance on road transport that have become a synonym to congestion and pollution.<sup>61</sup> More efficient operational procedures can provide greater capacity and potentially reduce congestion and the need for additional infrastructure. For example, every year thousands of empty barges move between ports on the

inland waterways, thereby underutilizing their potential capacity to transport commodities.<sup>62</sup> A backhaul policy could be implemented through the use of a small penalty tax for moving empty barges along the river, as implemented through governmental policy or a consortium on intermodal transportation.<sup>63</sup> This could encourage inland waterway shippers to exploit new technologies and explore additional transport opportunities. Although not as responsive as the trucking system, it greatly increases the potential value of inland waterways by contributing additional capacity to the overall transportation system. Maximizing new methods of transport, such as container-on-barge, further optimize existing waterway infrastructure without requiring massive new construction projects. Container-on-barge options provide shippers new options of using inland waterways to transit commodity items traditionally moved by other means.

In order to be an effective and reliable link in the transportation network, the inland waterway system requires adequate and consistent funding to remain a reliable mode of transport. Unlike road and rail, however, funding for new construction, operations, and maintenance (O&M) is shared by the federal government and commercial inland waterway users. The federal government continues to invest in navigation because of its benefit to the national economy. The distribution of cost between the federal government and the local project sponsor for waterways was established in the Water Resources Development Act (WRDA) of 1986 (Public Law 99-662). The Act established cost-share requirements for inland waterway projects that result in greater financial and decision-making role for non-federal stakeholders. The federal government typically pays 100% of costs associated with feasibility studies and O&M expenses. The Inland Waterway Trust Fund (IWTF), created in 1978, pays half the cost of the construction and major rehabilitation costs for specified federal inland waterways projects. It receives money from a tax on fuel (currently set at 20 cents per gallon) on vessels engaged in commercial transportation on inland waterways.<sup>64</sup> Typically, Congress appropriates funds from the federal general revenue fund (GR) as part of the annual process in the Energy and Water Development Appropriations bill to pay the other 50% of construction costs.<sup>65</sup>

Navigation industry groups argue that the current system makes a significant contribution to the national economy and that the aging infrastructure warrants increased investment by the federal government. The USDOT *Framework* advocates prioritizing timely operations and maintenance projects for inland waterways as a method of maintaining and preserving existing infrastructure.<sup>66</sup> Some taxpayer advocacy groups, however, oppose even current levels of federal investment and argue for a greater share of the financial burden to be borne by the users of these facilities.<sup>67</sup> A possible solution would be to share more of the cost of

infrastructure repair with users of the system. The inland waterway system, for example, not only supports navigation but also provides a multitude of recreational opportunities as well as hydroelectric power generation for constituents within their respective watersheds. Currently this public service provides little to no revenue for waterway infrastructure maintenance or construction. Funding needed improvements in the waterway system is a national problem.<sup>68</sup>

Effective integration of the U.S. Inland Waterway System is key to expanding the capacity of the national freight transportation infrastructure. Through strategic examination of the entire intermodal transportation system, and a detailed look at the many factors inhibiting the inland waterways from being a preferred route for goods movement, we can determine the best method of integrating the inland waterways system, leveraging them into the nation's current intermodal transportation system.<sup>69</sup> Traditional methods of overland transport are not easily usurped by inland waterways. The U.S. Inland Waterway System has historically served to move large, bulk cargoes and suffers from recent bouts of unreliability. Decreasing reliability of inland waterways is a factor of increasing age and recent budget constraints that combine to result in increased downtime at commercial lock facilities, both scheduled and unscheduled. USACE reports lock unavailability time has more than doubled since the early 1990s from about 60,000 hours to over 120,000 hours annually. Shippers on inland waterways can generally prepare for scheduled lock maintenance; however, unscheduled lock downtime can seriously disrupt shipment schedules and contract commitments, leaving shippers scrambling for delivery alternatives typically at a much higher cost.<sup>70</sup> Unfortunately, this trend is alarming to shippers and must be adequately addressed to leverage the capacity potential desperately needed to support national freight transportation requirements.

The inland waterway system infrastructure requires some modernization and expansion to account for changes in barge technology and capability. The current design and capacity of existing locks do not account for, or take advantage of, advances in barge operations.<sup>71</sup> Lock delays attributed to waiting in line to use the lock are currently over 550,000 hours annually, translating into about \$385 million in increased transportation costs.<sup>72</sup> USACE reports that some modernization of the system has been taking place since the 1950s-mainly along the Ohio River-with enlargement or replacement of older 600-foot lock chambers with new 1200-foot facilities that will pass a 15-barge tow in a single lockage. Other principal high volume waterways-the Upper Mississippi, Tennessee, and Illinois Rivers, as well as the Gulf Intracoastal Waterway remain dominated by 600-foot lock chambers.

One important trend improving the value and capability of the inland waterway system is the increase, especially since 2000, of container-on-barge transport. Containerization is

increasing the adaptability of inland ports to transport large quantities of goods on barges never before thought possible. The European Federation of Inland Ports estimates that further growth in the container sector is likely and inland ports will continue their investment efforts in this field in order to further improve their position in the transport market.<sup>73</sup> Containers can now hold non-traditional cargo such as liquids, perishable (using refrigeration) and non-perishable agricultural products, as well as bulk cargo such as minerals, petroleum, and others.<sup>74</sup> Improved cargo security is an important benefit of containerization. Container on barge is highly developed in Europe.<sup>75</sup> Containers are designed to be modular for easy interchange among transportation modes, allowing cargoes to be moved by the combination of ship, rail, and truck that best meets the needs of shippers and receivers.<sup>76</sup> Containers can hold more when transported by barge since they are not held to same weight limitations as overland transport. Every container transported by barge means one less truck on the highway. Container-on-barge operations save fuel, ease congestion on roads, and can haul hazardous materials or other cargo not suitable for transport through large population centers. Barges facilitate military deployment, moving unit containers and vehicles in a secure manner preventing pilferage and equipment damage associated with fast moving and relatively unguarded transport. Inland waterways are positioned to take some of the lower to moderate value container traffic off the even more congested roadways. The Columbia-Snake River system already has significant container-on-barge traffic, and similar services are growing along the Gulf Intra-coastal and North Atlantic ports.<sup>77</sup>

## Conclusion

The inland waterway system of the United States stands as a minimally exploited system that, if optimized, could help eliminate the congestion of overland transport, pollution, and provide a low cost alternative to long haul passages.<sup>78</sup> The USDOT should aggressively promote inland waterways as an effective alternative to overland transportation. U.S. Inland Waterway System stakeholders must embrace emerging technologies that more efficiently manage traffic on inland waterways to mitigate lock-imposed delays. An intra-governmental approach to managing national water resources must be better integrated at the local, state, and federal level, eliminating political impediments to system efficiency. Integrated planning to effectively link the national transportation network with state and local intermodal infrastructure must be encouraged and managed strategically. The federal government must lead efforts to develop adequate funding strategies, seeking public-private collaboration, to maintain the investment streams that support new construction, operations, and maintenance of the inland

waterway system, making it a reliable and affordable means of transportation in the future. Inland waterway infrastructure must be prioritized and resources focused on the most value-added gateways supporting objectives of the national freight transportation system. Overall the system should be repaired and modernized and, in certain cases, enlarged to meet the industry standard requirement for locks of 1200 feet. The federal government and the USDOT, using an interagency approach, must continue to develop transportation strategies that encourage the balanced growth of each industry sector, leading leads to more effective integration of inland waterway transportation. The USTRANSCOM deployment and distribution model should be commercially replicated at the national level to highlight alternative freight transportation planning opportunities that leverage the capabilities of each transport mode. The USDOT must provide shippers incentives for increased use of inland waterways, expanding container-on-barge opportunities to alleviate congestion and increase capacity of the freight transportation system at the national level.

In order to maintain our competitive edge, we must assure the strategic mobility of our economic and military elements of power. The inland waterway system can provide a key, strategic capability that enables the current and future economic prosperity and national security of the United States. The federal government, however, must efficiently manage, adequately fund, and effectively integrate inland waterways with other modes of transportation at the national level for this to achieve success. Promotion of the inland waterway system, using an interagency and intra-governmental approach, positions this capability to provide the additional capacity necessary to meet current and future freight transportation requirements. Leveraging the strategic value of inland waterways is integral to building an effective and reliable national transportation network for the 21<sup>st</sup> Century.

### Endnotes

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<sup>13</sup> USDOT, *Freight in America: A New National Picture*, 2.

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<sup>15</sup> USACE, "Inland Waterway Navigation: Value to the Nation", linked from the *Institute for Water Resources Home Page* at "Water Challenges" available from <http://www.iwr.usace.army.mil>; Internet; accessed 31 October 2006.

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<sup>33</sup> USDOT, *Freight in America: A New National Picture*, 1.

<sup>34</sup> USDOT, Maritime Administration (MARAD), “Strategic Plan for Fiscal Years 2003-2008”, linked from the *U.S. Department of Transportation Home Page* at “Maritime Administration, Strategic Plan for Fiscal Years 2003-2008”, available from <http://www.dot.gov/stratplan2011/redcong.htm>; Internet; accessed 22 November 2006.

<sup>35</sup> Ibid.

<sup>36</sup> USDOT, *Framework for a National Freight Policy*.

<sup>37</sup> Dunlop.

<sup>38</sup> USDOT, *Framework for a National Freight Policy*.

<sup>39</sup> USDOT, Framework for a National Freight policy says the key is developing a national, not federal, freight policy. The United States freight transportation system is a national system, not a federal system, composed of a vast array of interconnected public and private sector institutions and organizations. In recognition of this fact, solutions to transportation problems should be a collaborative effort with participation from both public and private organizations.

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<sup>42</sup> Ibid.

<sup>43</sup> Ibid.

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<sup>45</sup> USTRANSCOM, 5.

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<sup>51</sup> The Subcommittee on Water Resources and Environment, "Hearing on Contributions of Ports and Inland Waterways to the Nation's Intermodal Transportation System", available from <http://www.house.gov/transportation/water/09-17-03/09-17-03memo.html>; Internet, accessed 28 November 2006.

<sup>52</sup> Gerald Barnes, USACE, "Institutional Challenges to Improving U.S. Waterways," briefing slides with scripted commentary, Brussels, Belgium, 7 November 2006.

<sup>53</sup> USACE, “Inland Waterway Navigation: Value to the Nation”.

<sup>54</sup> Inland Waterways Users Board, *20<sup>th</sup> Annual Report to the Secretary of the Army and the U.S. Congress* (Washington, D.C.: Inland Waterways Users Board, March 2006), 29.

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<sup>57</sup> Ibid.

<sup>58</sup> USACE, “Inland Waterway Navigation: Value to the Nation”.

<sup>59</sup> Ibid.

<sup>60</sup> David Grier, USACE, “Inland Navigation Business Line: Overview of the Waterway System”, briefing slides with scripted commentary, Huntington, WV, 12 June 2006.

<sup>61</sup> European Commission.

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<sup>63</sup> Ibid., 30.

<sup>64</sup> ASCE.

<sup>65</sup> Congressional Research Service, The Library of Congress, *Report for Congress, Harbors and Inland Waterways: An Overview of Federal Financing*, (Washington, D.C.: Library of Congress, 12 January 2004), 2.

<sup>66</sup> Ibid.

<sup>67</sup> Ibid., 6.

<sup>68</sup> The Army Corps of Engineers estimates it would cost about \$125 billion dollars to replace the entire system.

<sup>69</sup> UVA, 5.

<sup>70</sup> David Grier, *The Challenge to Modernize the U.S. Inland Waterway*, n.d., 5.

<sup>71</sup> Locks can be categorized by three different sizes, as expressed in length. Currently about 15% of the lock chambers are 1000 to 1200 feet long, 60% are 600-999 feet long, and 25% are less than 600 feet. The lock size and tow size are critical factors in the amount of cargo that can pass through a lock in a given period of time. Technological advances in the towing industry now allow a single towboat to push a tow of 15 barges, which has an overall length of approximately 1200 feet. 15 barge tows have become the industry standard. Lock chambers smaller than 1200 feet require a 15-barge tow to separate and “double-lock.” “Double-locking” greatly increases the barge tow passage time from 30 minutes (1200-foot lock) to well over two hours (600-foot lock).

<sup>72</sup> USACE, "Listening Sessions: 2000", linked from the *Institute for Water Resources Home Page* at "Water Challenges" available from <http://www.iwr.usace.army.mil>; Internet; accessed 31 October 2006.

<sup>73</sup> European Commission.

<sup>74</sup> Containerization is a system of intermodal freight transport using standard International Organization for Standardization (ISO) containers that can be loaded and sealed intact onto container ships, barges, railroad cars, planes, and trucks. Containerization has revolutionized cargo shipping. Today approximately 90% of non-bulk cargo worldwide moves by containers stacked on transport ships. Most general cargo today, including manufactured goods and bulk commodities, can be moved in these reusable steel containers.

<sup>75</sup> David Grier, USACE, "Inland Navigation Business Line: Overview of the Waterway System".

<sup>76</sup> Some variations on the container exist. Open-topped versions covered by a fabric curtain are used to transport larger loads. A container called a "tanktainer", consisting of a tank fitted inside a standard container frame, allows liquids to be carried.

<sup>77</sup> Transportation Research Board of the National Academies, 168.

<sup>78</sup> UVA, 5.

